IN THE CLAIMS:

Claims 1, 10, 11 and 20 have been amended herein. All of the pending claims 1 through 20 are presented below. This listing of claims will replace all prior versions and listings of claims in the application. Please enter these claims as amended.

Listing of Claims:

1. (currently amended) A method of making a contact structure as part of an integrated circuit on a semiconductor wafer comprising:

providing a silicon region as a portion of the semiconductor wafer for making electrical contact thereto;

depositing a dielectric layer over at least a portion of the silicon region;

forming a contact opening through the dielectric layer exposing a portion of the silicon region, the contact opening having a sidewall;

depositing a titanium metal layer within the contact opening covering at least a portion of the silicon region exposed by the contact opening;

depositing an amorphous titanium carbonitride film having no definite crystalline structure and having virtually no crystalline titanium nitride therein, the amorphous titanium carbonitride film having a ratio of nitrogen atoms to carbon atoms falling within ~~the~~ a range of 5:1 to 10:1, the amorphous titanium carbonitride film lining at least a portion of the sidewall of the contact opening overlaying at least a portion of the titanium metal layer covering the at least a portion of the silicon region exposed by the contact opening; and

filling at least a portion of the contact opening using a material to form a contact structure.

2. (previously presented) The method of claim 1, wherein depositing the amorphous titanium carbonitride film comprises a chemical vapor deposition process.

3. (previously presented) The method of claim 2, wherein the chemical vapor deposition process includes:

evacuating a deposition chamber to a pressure of less than about 100 torr;

heating the semiconductor wafer to a temperature within a range of about 200° C to about 600° C;

maintaining the temperature of the semiconductor wafer within the range of about 200° C to about 600° C;

admitting an organometallic precursor compound into the deposition chamber, the organometallic precursor compound including a tetrakis-dialkylamido-titanium compound;

decomposing the organometallic precursor compound at least near a surface of the semiconductor wafer; and

depositing the amorphous titanium carbonitride film having no definite crystalline structure and having virtually no crystalline titanium nitride therein on at least a portion of the surface of the semiconductor wafer and within the at least a portion of the contact opening.

4. (original) The method of claim 3, wherein the organometallic precursor compound comprises tetrakis-dimethylamido-titanium.

5. (original) The method of claim 1, wherein the material comprises a metal selected from the group consisting of tungsten, aluminum, copper and nickel.

6. (original) The method of claim 1, wherein the material comprises doped polycrystalline silicon.

7. (previously presented) The method of claim 1, further comprising:
heating the semiconductor wafer; and
reacting at least a portion of the titanium metal layer covering the at least a portion of the silicon region exposed by the contact opening with the silicon region to form a titanium silicide layer.

8. (previously presented) The method of claim 7, wherein reacting the at least a portion of the titanium metal layer with the silicon region occurs prior to depositing the amorphous titanium carbonitride film having no definite crystalline structure and having virtually no crystalline titanium nitride therein.

9. (previously presented) The method of claim 7, wherein reacting the at least a portion of the titanium metal layer with the silicon region occurs subsequent to depositing the amorphous titanium carbonitride film having predominantly no definite crystalline structure and having virtually no crystalline titanium nitride therein.

10. (currently amended) The method of claim 1, further comprising:
subjecting the amorphous titanium carbonitride film having no definite crystalline structure and having virtually no crystalline titanium nitride therein to rapid thermal processing ~~in the~~ in presence of one or more gases selected from the group consisting of nitrogen, hydrogen and the noble gases.

11. (currently amended) A method of making a contact structure as part of an integrated circuit on a semiconductor wafer having at least one silicon region as a portion thereof comprising:
depositing a dielectric layer over at least a portion of the at least one silicon region;
forming a contact opening through the dielectric layer exposing a portion of the silicon region, the contact opening having a sidewall;

depositing a titanium metal layer within the contact opening covering at least a portion of the silicon region exposed by the contact opening;

depositing an amorphous titanium carbonitride film having no definite crystalline structure and having virtually ~~y no~~ no crystalline titanium nitride therein, the amorphous titanium carbonitride film having a ratio of nitrogen atoms to carbon atoms falling within ~~the~~ a range of 5:1 to 10:1, the amorphous titanium carbonitride film lining at least a portion of the sidewall of the contact opening overlaying at least a portion of the titanium metal layer covering the at least a portion of the silicon region exposed by the contact opening; and

filling at least a portion of the contact opening using a material to form a contact structure.

12. (previously presented) The method of claim 10, wherein depositing the amorphous titanium carbonitride film comprises a chemical vapor deposition process.

13. (previously presented) The method of claim 12, wherein the chemical vapor deposition process includes:

evacuating a deposition chamber to a pressure of less than about 100 torr;

heating the semiconductor wafer to a temperature within a range of about 200° C to about 600° C;

maintaining the temperature of the semiconductor wafer within the range of about 200° C to about 600° C;

admitting an organometallic precursor compound into the deposition chamber, the organometallic precursor compound including a tetrakis-dialkylamido-titanium compound;

decomposing the organometallic precursor compound at least near a surface of the semiconductor wafer; and

depositing the amorphous titanium carbonitride film having no definite crystalline structure and having virtually no crystalline titanium nitride therein on at least a portion of the surface of the semiconductor wafer and within the at least a portion of the contact opening.

14. (original) The method of claim 13, wherein the organometallic precursor compound comprises tetrakis-dimethylamido-titanium.

15. (previously presented) The method of claim 11, wherein the material comprises a metal selected from the group consisting of tungsten, aluminum, copper and nickel.

16. (previously presented) The method of claim 11, wherein the material comprises doped polycrystalline silicon.

17. (previously presented) The method of claim 11, further comprising:
heating the semiconductor wafer; and
reacting at least a portion of the titanium metal layer covering the at least a portion of the silicon region exposed by the contact opening with the silicon region to form a titanium silicide layer.

18. (previously presented) The method of claim 17, wherein reacting the at least a portion of the titanium metal layer with the silicon region occurs prior to depositing the amorphous titanium carbonitride film having no definite crystalline structure and having virtually no crystalline titanium nitride therein.

19. (previously presented) The method of claim 17, wherein reacting the at least a portion of the titanium metal layer with the silicon region occurs subsequent to depositing the amorphous titanium carbonitride film having no definite crystalline structure and having virtually no crystalline titanium nitride therein.

20. (currently amended) The method of claim 10, further comprising:
subjecting the amorphous titanium carbonitride film having no definite crystalline structure and having virtually no crystalline titanium nitride therein to rapid thermal processing in ~~the~~ presence of one or more gases selected from the group consisting of nitrogen, hydrogen and the noble gases.